

Performance of Alternate Fuel E-85:

A study by Organizational Results in cooperation with the Division of General Services and TranSystems Corporation.

Summary Statement:

MoDOT's real world experience with E-85 vehicles confirms that selecting a fuel is not a clear-cut decision, yet. This study provides tools to support decisions about the current and future fleet. It recommends maps and calculator cards, to help drivers find E-85 and make cost effective choices. This study also addresses driver's concerns. A policy encouraging E-85, even if it increases fuel costs, will encourage E-85 development, fewer emissions, less consumption of foreign fuels, better future availability, and potentially lower future costs.

Background:

Ethanol fuel E-85 is a hot topic for Missouri as related to local farming, businesses, environment, and economy. Federal regulations encourage E-85 and other alternative fuels. Accordingly, MoDOT's light fleet includes many Flex Fuel Vehicles (FFV), which run on any combination of gasoline and E-85. MoDOT's experience with these vehicles created impressions that E-85 and FFVs do not perform well. Specific concerns are: Fuel quality, starting in cold weather, running out of fuel between E-85 stations, less power, less miles per gallon, and not saving money because of higher costs per mile. MoDOT contracted with TranSystems to study real world experiences with E-85.

Results:

MoDOT had hoped the study would reveal a clear-cut winner between E-85 and gasoline fuels. Instead, it found close competition, although a winner could emerge with changes in prices of one or the other.

- **Literature Search:** The study reported ways other states encourage E-85 use in order to encourage local development, better air quality, less dependence on foreign fuel, and potentially lower E-85 costs in the future.
- **Fuel Quality:** Ethanol is more corrosive than gasoline, so it requires better tanks and lines. Otherwise, it is no more or less likely to have quality problems. Any fuel requires good suppliers and distributors to assure a pure product. Sampling and chemical testing can investigate fuel related problems, but fuel quality should not be the only cause investigated.
- **Cold Weather Starting:** Both E-85 and gasoline are formulated differently in the winter. If the winter formula is used, there should be no cold starting problems in Missouri. If this isn't reassuring enough, FFVs can fill up with gasoline when record lows are anticipated.
- **Running Out of Fuel Between Stations:**
 - The study plotted the range of MoDOT's best and worst vehicles using only E-85, based on tank size, miles per gallon, make and model. It found MoDOT's FFVs could fill up near Joplin and drive as far as Texas before running out of fuel.



Results (Continued):

- The study mapped the location of Missouri E-85 stations, finding good coverage except in the South Central District, where MoDOT has already added an E-85 tank.
- Although driving 100% on E-85 might require longer trips or extra planning, FFVs allow gasoline whenever E-85 is not available.
- MoDOT could encourage E-85 use with location information in vehicles.
- **Engine Maintenance:** Compared to hybrids, electrics, or hydrogen vehicles, FFV engines are substantially the same as gasoline engines. Fuel systems are more resistant to corrosion, and the only other change is addition of a sensor to adjust for any percent of ethanol.
 - Maintenance is the same for FFVs, and any engine problems should be diagnosed the same.
 - Switching between fuels is not an issue. FFVs can run full time on E-85, full time on gasoline, or any mix at any time.
 - If anything, FFV engines with E-85 are more reliable due to improved fuel systems and the cleaning nature of E-85.
- **Power Performance:** E-85 has a higher octane rating than gasoline, producing 5% to 7% more horsepower. Thus, power performance should not be a concern.
- **Efficiency Performance:** E-85 has less energy per gallon than gasoline, resulting in 20% to 30% fewer miles per gallon and less miles per tank. This performance is also affected by optimizations built into engines, which still favor gasoline. The study found some makes and models better or worse in E-85 efficiency, and the study provided a way for MoDOT to further investigate this for improved fleet purchases.
- **Efficiency in Costs:** E-85 is typically less expensive than gasoline, per gallon. However, with fewer miles per gallon from E-85, the price

per mile can be either higher or lower than gasoline, depending on prices and efficiencies. Prices vary with location and time, while efficiencies vary by make, model, and driver.

- The study provided ways for MoDOT to evaluate the fleet and make general decisions about fueling FFVs. Vehicles with poor efficiencies might be better with gasoline full time, while vehicles with good efficiencies might be better with E-85 full time.
- The study proposed informational cards in each vehicle, similar to “tip calculator” cards. These would show break-even E-85 prices per gasoline prices, for a vehicle’s make and model. If E-85 is less than shown, it should be purchased, otherwise gas should be purchased.
- Calculator cards could also be adjusted to factor in other considerations. For instance, if MoDOT is willing to pay a penny per mile more, in support of E-85, then the cards can be adjusted accordingly.

Other Advantages and Disadvantages of E-85:

- Emissions from using E-85 are less polluting than gasoline.
- Production of E-85 is more domestic than gasoline, so using E-85 reduces consumption of foreign oil.
- Using corn for ethanol production increases demand for corn with subsequent price increases.

The study shows many vantages change with time, such as prices per gallon. Another change is the total environmental impact of E-85 (farming, production, and distribution; as compared to gasoline related drilling, refining, and distribution). New technologies are reducing the total environmental impact. New technologies are also anticipated to allow production of ethanol from sources other than corn, including from waste materials. All these changes affect supply, demand, and costs, which change the advantages and disadvantages of E-85.